FAA Industry Training Standards (FITS)

Scenario Based Training, Course Developers Guide

A Guide for Training Providers, Fixed base Operators, and Aircraft Manufacturers

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Scenario Based Training, Course Developers Guide:

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CHAPTER I: Scenario Based Learning

Scenario Based Training (SBT)

A training system that uses a highly structured script of real-world experiences to address flight training objectives in an operational environment. Such training can include initial training, transition training, upgrade training, recurrent training, and special training. The appropriate term should appear with the term "Scenario Based," e.g., "Scenario Based Transition Training," to reflect the specific application.

Introduction

The introduction of Technically Advanced Aircraft (TAA) has highlighted the changing role of General Aviation (GA) from an industry dominated by pleasure flying to a viable alternative to the scheduled airlines. This places the pilot of any capable single or twin-engine aircraft in the ATC system, on an IFR clearance, and in and out of the weather on a routine basis. The TAA, with its glass displays, GPS, and autopilot may be inherently easier and safer to operate. However, since flying has become more complex, the focus of training needs to address pilot decision-making and risk management, a concept the authors call Single Pilot Resource Management (SRM). Since SRM training requires practicing the decision-making process in real time and in real situations, a new form of GA training that goes beyond the traditional task and maneuver-based training is recommended. The FITS program emphasizes combining traditional task and maneuver training with Scenario Based Training (SBT) to teach the advanced pilot judgment and risk management skills required in the SRM environment.

In many respects, scenario-based training is not a new concept. Experienced Certified Flight Instructors have been using scenarios to teach cross country operations, emergency procedures, and other flight skills for years. Airline training has incorporated Line Oriented Flight Training (LOFT) into its curriculum since the early 1980's and the military has used mission oriented training very successfully. However, this guide is provided to help integrate scenario-based training into the curriculum of general aviation flight schools and factory flight training programs for the first time.

General aviation SBT is designed specifically to develop pilot judgment and aeronautical decision-making skills. Improper pilot decisions cause a significant percentage of all accidents, and the majority of fatal accidents in light single and twin-engine aircraft. Simply put, scenario based training puts the student pilot into the normal cross-country environment much earlier than traditional flight training programs. The goal is to begin training the pilot, through meaningful repetition, how to gather information and make informed and timely decisions. We routinely refer to this process as "experience."

Normally, much of the experience we gain in pilot decision-making comes after our formal training is complete. However, the technological advances of the last decade have brought airplanes to market that are really at their best when operated within the national airspace system and on cross country flight profiles. In many cases these TAAs have more capability than the pilot is trained to use. Thus, the goal of this training is to challenge the pilot with a variety of flight scenarios. These scenarios require the pilot to manage the resources available in the cockpit, exercise sound judgment and make timely decisions.

Scenario-based learning does not preclude traditional maneuver based training. Rather, flight maneuvers are integrated into the flight scenarios and conducted, as they would occur in the real world. Those maneuvers requiring repetition may still be taught during concentrated settings. However, once they are learned, they are then integrated into realistic flight situations.

The Role of the Instructor in Scenario Based Training

Susan (student) and Bill (CFI) are flying scenario number ten which consists of a short cross country to a local airport for some practice landings followed by a return to the home airport located in class C airspace. While practicing landings at the non-tower airport the student notes that the ceiling is lowering and the crosswind is beginning to increase. In his own mind, Bill is convinced that they can practice landings for another 30 minutes to an hour and still return to home base. However, instead of telling Susan this, while taxiing back after a stop and go landing, he first asks her several questions?

- Has the flight situation changed since they left the home field?
- What does she think of the weather situation?
- How can we gain more information?
    - Check with FSS on the radio?
    - Stop at the FBO and call back to the FBO to check on weather and the schedule?
- Are there other issues?
    - Fuel?
    - Schedule?
    - Aircraft equipment (IFR/VFR) and pilot capability?

Susan decides that she would be more comfortable returning to the home airport and practicing landings there so as to not get caught out in the weather. Although, not his plan, it is a good plan based on accurate situational awareness and good risk management skills so Bill agrees. And Susan is now beginning to gain confidence by practicing her judgment and decision making skills. In the post flight critique, Susan leads a discussion of this and other decisions she has made in order to learn more about the process.

The Role of the Flight Instructor in

Scenario Based Training

In the past, the flight instructor was a very capable pilot with a very brief and rather general understanding of basic teaching methods and techniques. More recently, the FAA has paid more attention to the instructor's role as teacher and mentor, and through the Fundamentals of Instruction has provided a much better grounding in traditional instructional techniques. The instructor is now required to master the traditional behavioral teaching methods, write lesson objectives, outline and write lesson plans, and motivate students by example. The instructor, alone, is responsible for what is taught in the airplane. The amount of learning that takes place is a direct result of how well the lesson was prepared and the teaching skill of the instructor. Many differences in the quality and content of lessons exist. Instruction focuses on the performance of specific maneuvers and learning is measured with objective standards. Changing technology and innovations in learning provide the opportunity for new methods, new standards, and a new role for the flight instructor. As a result of the implementation of this new approach to training, the flight instructor's role becomes more of an Individual Learning Manager.

The Flight Instructor (as an Individual Learning Manager) is an integral part of the systems approach to training and is crucial to the implementation of a scenario-based training program. He/she is trained to function in the learning environment as an advisor and guide for the learner. The duties, responsibilities, and authority of the Flight Instructor include the following:

1. Orient new learners to the scenario-based training system.
2. Help the learner become a confident planner and in flight manager of each flight and a critical evaluator of their own performance.
3. Help the learner understand the knowledge requirements present in real world applications.
4. Diagnose learning difficulties and help the individual overcome them.
5. Be able to evaluate student progress and maintain appropriate records.
6. Provide continuous review of student learning.

As you might expect, the Flight Instructor is the key to success, and different instructional techniques are required for successful SBT. Remembering that the learning objective is for the student to be more ready to exercise sound judgment and make good decisions; ***the Flight Instructor must be ready to turn the responsibility for planning and execution of the flight over to the student as soon as possible.*** The Flight Instructor will continue to demonstrate and instruct skill maneuvers in the traditional manner, however, when the student begins to make decisions the Flight Instructor should revert to the role of mentor and/or learning facilitator.

Each situation a student faces may not have one right, and one wrong answer. Instead, students will encounter situations in training that may have several "good" outcomes, and few "poor" ones. Rather than requiring the student to make a decision that matches his own personal preference, the Flight Instructor should understand in advance which outcomes are positive and/or negative and give the student the freedom to make both good and poor decisions. This does not mean that the student should be allowed to make an unsafe decision or commit an unsafe act. However, it does allow the student to make decisions that fit their experience level and result in positive outcomes.

CHAPTER II: The Student and the Learning Process

FITS Flight Instructor / Student Relationships

The afternoon prior to flying scenario three, Linda (the Flight Instructor for the lesson) sends an E-mail to her student Brian and asks him to plan tomorrow's flight. She attaches a copy of the syllabus and task list to the E-mail and emphasizes that they need to work on both cockpit automation (MFD, GPS, and PFD) and pattern and landing skills. Her student puts together a short two leg cross country that will allow for plenty of pattern entry, an instrument approach, and landing work while using the enroute legs to explore the cockpit electronic displays. Brian, remembering that he did not really understand the physics behind power off stalls during the last lesson, also adds in a stall series.

The next day, Brian briefs Linda on his plan and presents his completed paperwork for the flight. Linda notes the addition of the stalls and approves of the plan. Once approved, she and her student engage in a discussion of the areas of the flight that he still does not understand and she quizzes him on proper procedures and possible situations and decisions they may encounter.

Once in the air, the student plans and executes the flight and Linda interjects comments and questions as the need arises. Linda alternates between demonstration, questioning, and suggesting alternate course of action always allowing Brian time to participate in the discussion.

Brian notes the change from his previous instruction in a non-FITS flight school. Quite often he would be told what to do and when to do it as the lesson progressed. Often more information would be presented in a rapid-fire sequence. However, since there was little time for reflection and discussion he had to repeat each task and maneuver many more times before he understood and could apply the knowledge.

Immediately after landing, both Brian and Linda take a moment and grade the flight. Each grades the flight separately using a learner centered grading criteria. During the critique and review they compare the grades and look for areas of disagreement. In fact, Brian notes that he is beginning to lead the post flight critique and is always mentally grading his own flight performance, habits he will maintain for his entire flying career.

Fortunately, for the Flight Instructor, learning is a continuous process going on constantly in all humans. The Flight Instructor has only to direct the course of learning to the specific instruction for which he is responsible. The "only" is a deceptive qualifier of what the Flight Instructor must do, for his experience and ability will be tested. The knowledge he gains through awareness of the learner's needs and desires in terms of human factors and psychological well-being will aid his ability to teach them.

Learning has been defined as a change in behavior as a direct result of experience. Teaching can be defined as the creation of experiences that allow learning to take place. So, if we put both definitions together, the job of the Flight Instructor is to skillfully and carefully craft a series of experiences that guide the learner to the proper changes in behavior, or the skills, knowledge, and attitudes, necessary to become a safe and competent pilot.

For example, a well-known author of behavioral learning techniques, Robert M. Gagne, lists various categories of learning in order of complexity and difficulty. A child on being told not to touch the hot stove does so (in many cases), thus learning the concept of "hot." The child is not apt to repeat this tactile experiment to reinforce the concept of "hot" (temperature sense) that is, of course, a very basic concept.

Most concepts we deal with in flight training are complex. Concept learning (discrimination between types of things or ideas in or outside of a concept set) is one of our greatest challenges and demands a much different approach to learning.

Learning Theory

Today's learning technology did not appear overnight. Early in the development of educational psychology, E.L. Thorndike suggested several laws of learning: the law of readiness, the law of exercise, and the law of effect. These three laws of learning are universally accepted and apply to all kinds of learning. Since Thorndike set down the basic three laws in the early part of the twentieth century, three additional laws have been added: the law of primacy, the law of intensity, and the law of recency. Short definitions of these laws as they apply to scenario-based training are as follows:

Readiness: Basic needs of the student must be satisfied before he is ready or capable of learning. The Flight Instructor can do little to motivate the learner if these needs have not been met. For our purposes it means that the student must want to learn the task being presented and must possess the requisite knowledge and skill. In SBT we attempt to make the task a meaningful as possible and to keep it within the students capabilities.

Exercise*:* Repetition or practice of the material to be learned is most effective when incorporated into meaningful applications. Exercise is most meaningful and effective when a skill or job performance process is learned within the context of a "real world" application.

Effect*:* This law of learning is concerned with the emotional reaction of the student to the stimulus. His reaction should be positive or pleasant rather than negative in nature. Negative reinforcement might stimulate forgetfulness. Positive reinforcement is more apt to lead to success and motivate the learner. Do not frustrate the student by confusing or confounding him/her with learning materials s/he is not capable of understanding. Scenario based learning when presented correctly provides immediate positive feedback in terms of real world applications.

Primacy*:* What the student learns must be procedurally correct and applied the very first time. A student's first exposure to a given learning challenge is the most positive. If the task is learned in isolation, is not initially applied to the overall performance or if it must be relearned, the process can be confusing and time consuming. This applies to learning procedures, task and maneuvers within a context or situation.

Intensity: The more immediate and dramatic the learning is to a real situation, the more impressive the learning is upon the student. Real world applications (scenarios) that integrate procedures and tasks that the student is capable of learning will make a vivid impression on him. S/He is least likely to forget a meaningful exercise for which s/he is ready.

Recency: The closer the training or learning time is to the time of actual responsibility, the more apt the learner will be to perform successfully on the job. This law is most effectively addressed by making the training experience as much like the actual job as possible. As the Air Force says**: "Fly the way you Train, and Train the way you Fly**." ***In FITS training, the skills are integrated into the scenario.***

Adult Learners

The field of education for adults has been fundamentally changed by the work of Malcolm Knowles. His pioneering work in the field of adult and continuing education is based on two sets of observations. First, adult learners are defined not by their physical age, but by their psychological approach to learning. Children who come to the learning environment are usually directed by parents, local laws, or societal pressure. They are essentially directed by forces outside themselves to learn a specific subject, or set of subjects. In order for these individuals to learn, they may have to be externally motivated as well, usually through tests, quizzes, and traditional grading systems. Their learning is typically subject and teacher centered since they did not particularly decide to learn the information in the first place. They come to the learning environment with little prior knowledge and are essentially a blank slate for the teacher to write on. For these students, repetition and a tightly controlled teacher centered learning environment keeps them on track. While some flight students fall into this category, most do not.

Knowles learned that adult learners are different. They want to come to the learning environment and are willing to sacrifice their own time and money to learn. They are self-motivated and come to the learning environment with much prior knowledge, many life experiences and a well-developed self-concept. They are identified by five characteristics:

Table 1: Characteristics of Adult Learners

Characteristics of Adult Learners 1. **Self-concept**: *As a person matures his self-concept moves from one of being a dependent personality toward one of being a self-directed human being.* 2. **Experience**: *As a person matures he accumulates **a growing reservoir of experience** that becomes an increasing resource for learning.* 3. **Readiness to learn**. *As a person matures his readiness to learn becomes **oriented increasingly to the requirements of daily life and career.*** 4. **Orientation to learning**. *As a person matures his time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly his orientation toward learning shifts from **one of subject-centeredness to one of problem centeredness.*** 5. **Motivation to learn**: *As a person matures **the motivation to learn is internal.***

Smith, M. K. (2002) 'Malcolm Knowles, informal adult education, self-direction and anadragogy', *the encyclopedia of informal education*, www.infed.org/thinkers/et-knowl.htm

Simply put, adults learn best in an environment that allows them to use their experience to resolve real time problems (scenarios) that replicate the real world. They are success oriented and like to have a voice in the conduct of the learning process. Whether or not adults can verbalize it, they have begun to understand how they learn best and if given the chance, will structure the learning process to fit that model. Knowles describes these individuals as self-directed learners.

Table 2: Self-Directed learners

Self-Directed Learners
... In which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes.

Smith, M. K. (2002) 'Malcolm Knowles, informal adult education, self-direction and anadragogy', *the encyclopedia of informal education*, www.infed.org/thinkers/et-knowl.htm

While all flight students do not meet the requirements of a self-directed learner, many more than we now realize are adult learners and will respond to learner centered instructional techniques like scenario based training and problem centered learning. Once we understand how the adult flight student learns best we must also understand the physical process of learning.

How People Learn

One theory of how people learn can be likened to a computer system: input, processing, and storage/retrieval. This theory is briefly described in the Aviation Instructor's Handbook. Consider it like a "learning system," and like any system, it has limitations and must be operated properly. Whereas a computer gets input from a keyboard, mouse, maybe a camera or scanner, the human brain gets input from the senses: sight, hearing, touch, taste, and smell. The amount of sensory input that the brain received per second ranges from thousands to millions of bits of information according to various theories. Regardless of the number, that is a lot of information for the brain to track and process.

One way the brain deals with all this information is to leave many of the habitual and routine things we do go unnoticed. For example, using the rudder when entering a turn.

Most of us aren't even aware we are pressing the pedal, even though our muscles are moving, our leg is moving, our foot is feeling the pressure on the pedal, etc. Our subconscious is taking care of things for us, leaving our conscious thought processes free to deal with issues that are not habitual. Another example of this has probably happened to you on a long trip in a car. You get into a conversation with a traveling companion. After a while, the traffic in front of you suddenly begins to slow down. You step on the brakes, slow down, and then look around. You realize that you don't remember anything you saw while driving the last 50 miles or so. What has happened is your subconscious, or sensory register, has taken care of the routine, habitual tasks associated with driving thereby allowing you to carry on your conversation. Yet, when the brake lights appeared on the cars and trucks in front of you, your sensory register made your working memory aware of the new situation that required non-routine actions.

Another thing to point out in this example is how the brain recognized the red brake lights as being something important. Society has decided that red lights on the back of cars mean that the cars are using their brakes to slow down. The sensory register has been conditioned to recognize red lights on the back of cars as something important usually requiring action. When the sensory register picked up the red lights, it recognized them as something important for you to know in case you needed to do something, like slow down or stop yourself. This is known as pre-coding the sensory register.

Students first learning to fly, have not developed their skills to the point they are habits. What this means the Flight Instructor as an Individual Learning Manager is that most of the time, your students are using the conscious part of the brain to fly. And this can lead to problems dealing with the amount of information they can process at any one time, as an explanation of the working memory will show.

Working memory is where conscious thought takes place and where we generate our deliberate actions and reactions with the world around us. Filtered information from the sensory register is used with information retrieved from long-term memory so we can solve problems, make decisions, and do things. While we can do wonderful things with our brains, there are limitations. One of the biggest limitations that Flight Instructors will have to deal with as Flight Instructor is the limited capacity of working memory. Research has shown that the number of things we can pay attention to is around 7 (+/- 2). Another fact is that working memory has a time limit of about 1 minute. So, our bodies are picking up thousands or more of inputs that are being filtered by the sensory register that sends only the most important things to our working memory so we can either use the information to do something or we can process it for long-term storage. Processing information for long-term storage so it can be used in the future is the goal of any learning situation. So, how does a bit of information get processed so we can use it in the future?

When a bit of information is being processed for storage, the first thing that happens is that the brain tries to associate the new information with something already known. If not, then it tries to store the information in a manner that “makes sense.” But sometimes “making sense” can lead to errors. This is why if you are going from the known to the unknown as described in the Aviation Instructor’s Handbook is one of the better methods to use.

It takes the brain about 5-10 seconds to process the typical bit of information for storage. It is critical that this time period be as free from distractions as possible as the information can be lost in a little as 20 seconds if there is interference with this process. If information is given too fast, the student won't have time to properly process the information. If the student is still thinking about something just learned, this will interfere with processing of new information. By giving the student time to think, you can greatly increase the retention of new material. Remember the brain can only work with a limited amount of information at any given time, and new students are using the majority of their capacity to perform tasks that are habitual and routine to more experienced pilots.

One thing to consider with regards to the limitations on working memory is taking the controls of the airplane when you want a student to pay attention to what you are telling them. An example of this during the training in TAA's would be to take the airplane and fly it (or engage the autopilot) while the student practices programming the navigation equipment. By making the student fly the airplane and program at the same time will degrade their performance in both. This can have a negative affect on the student's motivation and confidence. Once the student has gained a bit of experience programming the navigation equipment, then both tasks can be combined with positive results.

The same can be true when teaching take-offs and landings to a beginning student. During a touch and go, the student is debriefed on their approach and landings while on the departure leg. Again, considering the limitations on working memory and the fact a beginning student can't perform all of the tasks by routine and habit. Most likely the student will concentrate on heading, altitude and airspeed control during the climb out, check for traffic ahead in the pattern, look for landmarks and other cues to turn crosswind, etc. It is a safe bet that not much of the remaining capacity of working memory is really grasping anything about the debriefing you are providing on their previous landing attempt, much less understand what needs to be done on this attempt to prevent repeating mistakes. A better solution would be to make the landing a full stop. After clearing the runway, exchange controls with the student. Since you have the experience to taxi and talk at the same time, you can taxi the airplane back for departure and debrief the student on their landing. The student is free of all tasks associated with controlling the airplane and can better comprehend what you are telling them. After you have discussed what you need to with the student and have answered any questions, you can then give the controls back to the student and continue the lesson. After the student gains enough experience many of the tasks in the traffic pattern will become more habitual, then you can consider doing touch and goes.

When information is being processed for storage, research has shown that simultaneous visual and verbal input can be processed without interfering with each other. An example of this is flying the airplane and listening to you or ATC at the same time. However, two simultaneous visual or verbal inputs will interfere with each other and can result in both failing to be properly processed. An example is when the student is trying to listen to both you and ATC. Afterwards they usually cannot tell you what either one said. An example of two visual inputs interfering is trying to watch a video clip on the evening news and also read the scrolling news at the bottom of the screen. This can impact the training in TAA aircraft because of the wealth of information presented on the two display screens, especially with data linked information that must be read. Trying to read a weather report on the MFD while flying instruments on the PFD can result in less than desirable results in both areas. Again, as the students gain experience, these tasks become easier as students learn to divide their attention appropriately.

The final component of the "learning system" is long-term memory. This is where information resides in the brain. And like the other components, there are some things to consider in order to increase long-term retention.

The first thing to consider is that long-term memory is not an exact recall of events but is a reconstruction of them. Generally, when people remember something, the memory is reconstructed from bits and details that are put together to form the memory. This can explain why two people can witness the same thing and later, have two totally different versions of the memory. Memory can be influenced by many factors; social, political, personal, etc. The brain tries to tie all of the bits and pieces of the event together to create the whole memory. What this means with respect to teaching and learning is that if the only way a student learned something is through verbal inputs, then the student has only the memory of those verbal inputs, plus any self-made images and understanding to recreate the memory. But, if several types of inputs are used, verbal, visual, logic, sequential, etc., then the student is better equipped to recreate the correct memory.

If the learning is done in context, the student has the contextual cues to further enhance their ability to correctly reconstruct the memory. This is one of the goals of scenario-based training, to put the learning in a real-world context so it can be used better in the real world.

So, what does this mean to the Flight Instructor and FITS? There are several rules that can be derived from this that can apply not only to FITS scenario-based training, but also to all training.

***Rule 1: Have the student conduct a proper and thorough preflight briefing*.**

The student should verbalize the plan for the day's events including route and a detailed sequence of events. The Flight Instructor should then point out where the key learning aspects of the lesson are covered, where in the lesson they will occur and what the student should look for while performing the lesson. This sets the sensory register to detect what is important and also prepares the mind for what cues to remember.

Rule 2: Don't overload the student with new information or tasks.

Remember, in the beginning a student has not developed the skills to perform the tasks we take for granted as routine and has to pay more attention to them. If you want a student to listen to what you are saying, take the controls or let the autopilot fly the airplane. Also, if the student is already a competent pilot and is only learning new equipment, consider early use of the autopilot to ensure their comfort with the automation and reinforce that in a complicated flight environment it is a tool to be used. After some skill with the new equipment has been gained, then have the student perform them while flying. This is the reverse of the traditional hand flying skills first approach but has been very successful in the airline pilot training programs in producing pilots who manage cockpit resources and tasks.

Rule 3: Don't try to teach very important or complex items in a busy ATC environment or other situations where conflicting visual or verbal cues will occur.

Early on, try to teach in an environment that is free from interference until the point where the student has gained some competence. Start with simple flight scenarios in less crowded airspace followed by more complex scenarios in more crowded airspace. For example, don't teach the student to obtain weather information via data link for the first time while maneuvering for an approach in simulated instrument conditions. Consider doing this first during the enroute phase of the flight in VMC. After the student has gained some competence, then you can consider having them check the weather at an alternate while being vectored for an approach.

Rule 4: Use as many types of cues or inputs as possible.

For example, when helping the student learn how to pre-flight the airplane, describe how to conduct the preflight and what to look for (verbal), walk through a preflight with the student showing them each item (visual), have them touch and manipulate all of the items that safely can (tactile/kinesthetic), the reasons for checking everything (logic) and the flow to follow during the preflight inspection (sequential).

Rule 5: Define new terms and how they relate to previous knowledge.

Remember that one of the easiest ways to speed learning is to relate new material to existing knowledge. Adult learners come replete with a variety of similar experiences, some similar to flying and some not. For instance, most Flight Instructors have had to fight the "steering wheel" affect as they help students learn the use of the rudders during taxi. On the other hand, most adults have a well-developed decision making system. Try to build and improve on that as they learn aeronautical decision-making.

Rule 6: Allow time for the student to process new information before moving to the next item.

Don't cover too much too fast. It takes 5-10 seconds for students to properly store information. Allowing them to use the new information in a practical application as soon as possible will also help increase retention. Giving control of the learning environment (scenario planning and execution) will let the student control how fast they learn the information. Allow, and in fact encourage, students to stop you and clarify things if necessary before moving on. If you don't, adult students will often remain on the previous subject.

Scenario based training is a compilation of basic learning theory, adult learning concepts, and the best of the traditional flight training procedures. Above all, it is about learning complex tasks in a realistic environment at a pace and in a structure that the individual student can comprehend and process. Good teaching techniques are still important, but only if they aid in student learning.

CHAPTER III: The Scenario-Based Approach to Training

Scenario Based ATC Training

Much like pilots, Air Traffic Controllers are expected to perform a myriad of tasks from talking on the radios, programming the computer based flight strips, and applying FAA regulations to individual flight situations. However, unlike flight training which delays this process until the cross-country phase of flight training, Air Traffic Controllers rapidly advance to real world scenarios, often in simulators like the one pictured above, that combine all these tasks into a completed work. These ATC scenarios start out rather simply, then progress in complexity and intensity as the student can handle the learning load.

Consider the following example: The Flight Instructor provides a detailed explanation on how to control for wind drift. The explanation includes a thorough coverage of heading, speed, angle of bank, altitude, terrain, and wind direction plus velocity. The explanation is followed by a demonstration and repeated practice of a specific flight maneuver, such as turns around a point or S turns across the road until the maneuver can be consistently accomplished in a safe and effective manner within a specified limit of heading, altitude, and airspeed**. *At the end of this lesson, the student is only capable of performing the maneuver.***

Now, consider a different example. The student is asked to plan for the arrival at a specific uncontrolled airport. The planning should take into consideration the possible wind conditions, arrival paths, airport information and communication procedures, available runways, recommended traffic patterns, courses of action, and preparation for unexpected situations. Upon arrival at the airport the student makes decisions (with guidance and feedback as necessary) to safely enter and fly the traffic pattern. This is followed by a discussion of what was done, why it was done, the consequences, and other possible courses of action and how it applies to other airports. ***At the end of this lesson the student is capable of explaining the safe arrival at any uncontrolled airport in any wind condition.***

The first example is one of traditional learning, where the focus is on the maneuver. The second is an example of scenario-based learning, where the focus is on real world performance. Many learning developers in flight training have built on the former option. Traditional training methods in many instances are giving way to more realistic and fluid forms of learning. The industry is moving from traditional knowledge-related learning outcomes to an emphasis on increased internalized learning in which learners are able to assess situations and appropriately react. Knowledge components are becoming an important side effect of a dynamic learning experience.

Reality is the ultimate learning situation and scenario-based training attempts to get as close as possible to this ideal. In simple terms, scenario-based training addresses learning that occurs in a context or situation. It is based on the concept of ***situated cognition***, which is the idea that knowledge cannot be known and fully understood independent of its context. ***In other words, we learn better, the more realistic the situation is and the more we are counted on to perform.***

Michael Hebron, a well-known golf instructor suggests that there is little the expert can do in the way of teaching the learner particular motions of the golf swing. Instead, learning has to be experiential and feedback based; only a handful of basic principles are involved. The same goes, he says, for any and all kinds of learning. ***"It's about learning, not about golf."***

Scenario-based training (SBT) is similar to the experiential model of learning. The adherents of experiential learning are fairly adamant about how people learn. They would tell us that learning seldom takes place by rote. Learning occurs because we immerse ourselves in a situation in which we are forced to perform. We get feedback from our environment and adjust our behavior. We do this automatically and with such frequency in a compressed timeframe that we hardly notice we are going through a learning process. Indeed, we may not even be able to recite particular principles or describe how and why we engaged in a specific behavior. Yet, we are still able to replicate the behavior with increasing skill as we practice. If we could ask Mark MacGuire to map out the actions that describe how he hits a home run, he would probable look at us dumbfounded and say, "I just do it."

On the other hand, I am sure Mark MacGuire could describe in detail the size and characteristics of every one of the baseball diamonds he was playing in as well as the strengths, weaknesses and common practices of every one of the pitchers he faced.

Developing Scenario-Based Training

Scenario-based training best fits an open philosophy of blended and multiple learning solutions in which change and experience are valued and the lines between training and performance improvement are blurred. For scenario-based training to be effective it must generally follow a performance improvement imperative. The focus is on improved outcomes rather than the acquisition of knowledge and skills. Success requires a blended, performance-based, and reinforced solution.

An athletic exercise such as Basketball might prove to be a very good example. Clearly, the team's objective is to win, which means scoring more points than the other team. That's the performance objective. Each member of the team also has personal performance goals. The coach can stand at a blackboard and explain defensive and offensive diagrams with players, the rules of the game, and so forth. By doing that, he has identified a set of learning subjects (rules and play patterns) that are best delivered in a traditional fashion.

On the other hand, the application of these subjects and the level of proficiency required in their use can only be learned on the court. The scenario in this example is a scrimmage. During a typical scrimmage, experienced players are mixed with non-experienced players and matched against a similarly constituted practice team. The two teams play a game, and the coaches stop the action at appropriate intervals to offer feedback. Learning takes place in a highly iterative fashion often without the player realizing that specific bits of learning are taking place. The scrimmage provides a player with the opportunity to make several decisions, engage in complex and fast-paced behaviors, and immediately see impact. The coach may have some general ideas of basketball in mind and perhaps some specific learning objectives for the day, but in most cases does not know precisely which of them will be addressed during the scrimmage – that depends on the flow of practice.

Similarly, most flight training consists of both kinds of subjects: those amenable to traditional instructional design techniques and those better approached through scenario-based training. Neither is all that useful without the other. Before a learner can engage in a scenario, he or she needs some basic subject knowledge and skill. However, the strongest adherents of the scenario-based approach suggest very little subject knowledge is needed in order to take advantage of SBT. The main point is that knowledge without application is worth very little.

The first step in the scenario design process is to engage a number of subject matter experts in a series of discovery sessions and interactive meetings for the purpose of identifying issues and learning objectives including higher-level and performance objectives. With clearly identified learning objectives, appropriate techniques and where to use them can be specified.

In the basketball example, players need some rudimentary knowledge of the game and basic skill in order to make the practice session efficient and effective. Consequently, the required knowledge and skill objects need to be integrated into the actual sessions of practice. So, like a train pulling a number of boxcars, a traditional piece of learning precedes or is integrated into a scenario, with the scenario dictating what information is covered in the traditional piece. If, as described in the scrimmage session above, you don't precisely know what will come up in the practice, you shouldn't waste time in the traditional preparation. It's more efficient to share very basic principles and devote your resources to preparing to teach any situation that may arise. What is important, however, is to establish the boundaries of the scenarios. These are done using performance-based learning objectives (Internalized Responses) as opposed to knowledge-based learning objectives, and are worded as performance objectives rather than skill-based behavior objectives.

For example, in the traditional, more repetition intensive flight training sessions, objectives are knowledge-based and tend to be specific and limited. On the other hand, in scenario-based training we are simply trying to determine whether the learner has the minimum necessary knowledge/skill to qualify for the scenario. With scenario-based objectives, we are looking for performance behaviors and indicators of internalized responses, which are usually situational recognition indicators.

We can see this clearly illustrated in an automobile driver-training example (Table 3). The traditional Behavior (skill) objective is knowledge based and the SBT Performance objective is performance-based (responses which are situational recognition indicators).

Table 3: Driving Learning Objectives

	Knowledge	Behavior (Skill)
Traditional	Know what a STOP sign and a Railroad crossing sign look like and what they mean. Describe the correct parallel parking procedure	Drive an automatic shift car on a county road over a 2-mile route with one RR crossing and 2 full stops. Maneuver the automobile into a normal parallel parking space between 2 other cars.
	Internalized Response	**Performance**
Scenario-Based	Appropriately apply the rules of the road for driving in the local area in moderate traffic. Determine the shortest route and apply the appropriate procedures for driving in heavy and complex traffic conditions.	Drive from your garage to the Shopping Center on the same side of town Drive from your garage to a specified address in another town over 50 miles away on the Interstate and an Expressway system.

Scenario design sessions should resemble focus groups in which participants work through a series of issues, from broad scenario outlines to very specific scenario details. Direct participants to address two general areas: content and style.

Sessions to determine content usually ask participants to:

- Share experiences about the subject event
- Describe desirable outcomes
- Share best practices or known instances of consistent achievement of the desired outcomes
- Create indicators of successful outcomes
- Create strategies expected to lead to successful outcomes
- Establish descriptions of successful and unsuccessful performance behaviors related to these strategies (note that outcome measures and performance behaviors will constitute the evaluative criteria for assessing performance in the scenario).

After the content discussion, ask participants to review the look, feel, and flow of the scenario. This is much like the process used for instructional design. Develop a storyboard with a general beginning and end, using the boundaries established earlier. Talk through the scenario in the session and, through iteration, create a flow script from the results.

With these two elements in place, you can begin the actual construction of the scenario. A subcommittee of Flight Instructors and subject matter experts (SMEs) should review and revise the scenario to fit into the whole course of instruction.

Scenarios are meant to be real situations. In an ideal world, an assessment team would evaluate behavior and agree on several critical performance dimensions. The key indicators should come from the initial SMEs, in which they also create strategies expected to lead to successful outcomes and establish descriptions of successful and unsuccessful performance behaviors. Outcome measures and performance behaviors will constitute the evaluative criteria for assessing performance in the scenario.

Examples of indicators of successful outcomes are whether an airplane arrived and was secured at the destination airport and how safe were all aspects of the flight or were there any regulatory violations. Strategies are clusters of internally consistent behaviors directed toward the achievement of a goal. Performance behaviors are the key behaviors in those strategies. Establishing these dimensions should be a group process and is usually completed in the subject matter expert design session.

Review, obtain learner feedback, and revise**.** All learning, even the most traditional, is iterative. The key to creating a useful scenario is to see it as a learning experience for the designers as well as the learners. This means that results and comments about the learning experience are shared with the SMEs and the designer so that they can review and modify the scenarios as necessary. Obtain open –ended qualitative data from the learner and the Flight Instructor about the experience and review the data with the SME's and the designer.

Based on this kind of feedback, scenarios can be revised to better target the learner population. That process mirrors the original design steps. There are some cautions, however, in the revision process. First, there is an old saying: “It doesn’t take a cannon to blow away a tin can.” Basically, revisions should not needlessly complicate the scenario or the technology needed to employ it. It is crucial to weigh the risks of complication against the genuine learning needs. Before any revision, affirm the original purpose statement and the categorization of learning elements.

Also, do not let principles and main points become diluted by revisions. It is tempting to add more items and nuances in a scenario, but doing so further complicates the learning process. Save complexity for a full-scale “capstone” experience. Remember, adding an item in traditional learning complicates the learning process in a linear fashion. In scenarios, complication grows non-linearly with the addition of learning items. So, beware. A rule of thumb is to reduce rather than increase principles and main points in a revision.

Always review success and failure paths for realism. Remember that any change in a scenario item complicates all items on the path following it. Any time a decision node is altered, chances are that the decision nodes and information items following it must change. With every revision, follow and ensure the consistency of associated paths.

Finally, remember that traditional learning elements should service the scenario-based learning elements, which are situated in a real context and based on the idea that knowledge cannot be known and fully understood independent of its context. It is essential to place boundaries around scenarios to make the transitions between scenarios and traditional learning as efficient as possible.

Table 4: The Main Points

- Scenario-based training (SBT) is situated in a real context and is based on the idea that knowledge cannot be known and fully understood independent of its context.
- SBT accords with a performance improvement and behavior change philosophy of the learning function.
- SBT is different from traditional instructional design and one must be aware of the differences to successfully employ SBT.
- All learning solutions should employ both traditional and scenario-based training.
- Traditional learning elements should service the scenario-based training elements.
- It is essential to place boundaries around scenarios to make the transitions between scenarios and traditional learning as efficient as possible.
- Use interactive discovery techniques with subject matter experts (SMEs) and designers to establish the purpose and outcomes of scenarios create the scenarios and appropriate strategies and performance behaviors, and develop learner evaluation criteria.
- SBT occurs by following success and failure paths through a realistic situation. Typically, these paths must be limited to stress the main learning objective. Otherwise the scenario can become too complex and unwieldy.
- Open-ended qualitative learner feedback is key to successful scenario revision, but revisions should not further complicate the scenario unless highly justified.

Kindley, R. (2002). *Scenario-Based E-Learning: A Step Beyond Traditional E-Learning.* Retrieved 02/02/05 from http://www.learningcircuits.org/2002/may2002/kindley.html

CHAPTER IV: Single Pilot Resource Management

Single Pilot Resource Management (SRM)

The art and science of managing all the resources (both on-board the aircraft and from outside sources) available to a single-pilot (prior and during flight) to ensure that the successful outcome of the flight is never in doubt.

The emerging class of Very Light Jet (VLJ) Aircraft (such as the Eclipse 500 pictured above) will revolutionize the way America travels. Central to their economic success is the concept of single pilot operations. Since the aircraft is heavily automated, the pilot's workload may actually be less than the current workload in a high performance single engine aircraft of today. This will allow much more time for the pilot to gather and analyze information about weather, winds, landing conditions, fuel state, pilot physical condition, and passenger desires.

However, unless the pilot is trained to manage all of these factors and to let the aircraft automation assist, the workload may be very high. SRM training helps the pilot maintain situational awareness by managing the automation and associated aircraft control and navigation tasks. This enables the pilot to accurately assess and manage risk and make accurate and timely decisions. ***This is what SRM is all about, helping pilots learn how to gather information, analyze it, and make decisions.***

Teaching pilots to identify problems, analyze the information, and make informed and timely decisions is one of the most difficult tasks for course developers. By way of comparison, the training of specific maneuvers is fairly straightforward and reasonably easy to understand. We explain, demonstrate, and practice a maneuver until proficiency is achieved. We are teaching the student ***"what to think"*** about each maneuver, and sign them off when they demonstrate proficiency. Teaching judgment is harder. Now we are faced with teaching the student ***"how to think"*** in the endless variety of situations they may encounter while flying out in the "real world." Often, they learn this by watching us. They observe how we react, and more importantly how we "act" during flight situations and they often adapt our styles to their own personalities.

Most of us remember a favorite Instructor from our past who showed us the best way to solve in-flight problems and unforeseen circumstances. The FITS team has combined much of this collective CFI body of knowledge with some innovative teaching methods to give coursedevelopers practical tools to teach aeronautical decision-making and judgment. It is called Single Pilot Resource Management (SRM).

The SRM scenarios, developed by the FITS team, incorporate several maneuvers and flight situations into realistic flight scenarios. The scenarios are much like the Line Oriented Flight Training (LOFT) employed by the major corporate and airline training organizations for years. Students may range from 100-hour VFR-only pilots, all the way to multi-thousand hours ATP's. The strength of this format is that the participants learn not only from their Flight Instructor, but from each other as well. The collective knowledge of many pilots, when guided by an experienced CFI, is much greater than the knowledge of each participant, including the Flight Instructor.

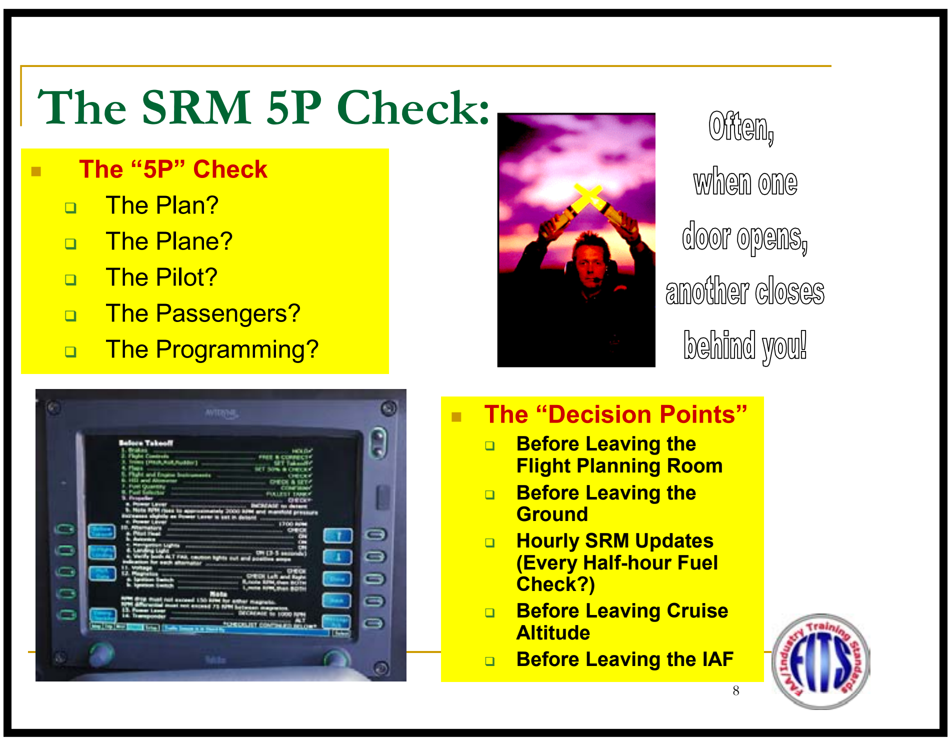
In these scenarios, there are no right answers, rather each pilot is expected to analyze each situation in light of their experience level, personal minimums, and current physical and mental readiness level, and make their own decision.

SRM includes the concepts of Aeronautical Decision Making (ADM), Risk Management (RM), and Situational Awareness (SA) with the, relatively new to General Aviation, concepts of Task and Automation Management. Pilots of the fleet of fast moving and well-equipped TAA's flooding the market today need to manage the entire flight profile much like their counterparts in glass cockpit airliners. Thus, SRM is much like Crew Resource Management (CRM), but focused on the needs of the single pilot.

Table 5: Single Pilot Resource Management (SRM)

Single Pilot Resource Management (SRM)		
The art and science of managing all the resources (both on-board the aircraft and from outside sources) available to a single-pilot (prior and during flight) to ensure that the successful outcome of the flight is never in doubt.		
Performance	**Conditions**	**Standards**
The training task is:	**The training is conducted during:**	**The pilot in training will:**
1. Task Management (TM)	Note: All tasks under SRM will be embedded into the curriculum and the training will occur selectively during all phases of training. SRM will be graded as it occurs during the training scenario syllabus.	Prioritize and select the most appropriate tasks (or series of tasks) to ensure successful completion of the training scenario.
2. Automation Management (AM)		Program and utilize the most appropriate and useful modes of cockpit automation to ensure successful completion of the training scenario.
3. Risk Management (RM) and Aeronautical Decision-Making (ADM)		Consistently make informed decisions in a timely manner based on the task at hand and a thorough knowledge and use of all available resources.
4. Situational Awareness (SA)		Be aware of all factors such as traffic, weather, fuel state, aircraft mechanical condition, and pilot fatigue level that may have an impact on the successful completion of the training scenario.
5. Controlled Flight Into Terrain (CFIT) Awareness		Understand, describe, and apply techniques to avoid CFIT encounters; a. During inadvertent encounters with IMC during VFR flight; b. During system and navigation failures and physiological incidents during IFR flight.

SRM sounds good on paper, however it requires a way for pilots to understand and deploy it in their daily flights. This practical application is called the "Five P's (5P's)" The 5P's consist of "the Plan, the Plane, the Pilot, the Passengers, and the Programming". Each of these areas consists of a set of challenges and opportunities that face a single pilot. And each can substantially increase or decrease the risk of successfully completing the flight based on the pilot's ability to make informed and timely decisions. The 5P's are used to evaluate the pilot's current situation at key decision points during the flight, or when an emergency arises. These decision points include, pre-flight, pre-takeoff, hourly or at the midpoint of the flight, pre-descent, and just prior to the final approach fix or landing.



The 5P's are based on the idea that the pilots have essentially five variables that impact his or her environment and that can cause the pilot to make a single critical decision, or several less critical decisions, that when added together can create a critical outcome. ***These variables are the Plan, the Plane, the Pilot, the Passengers, and the Programming of the automation***.

The authors of the FITS concept felt that current decision-making models tended to be reactionary in nature. A change has to occur and be detected to drive a risk management decision by the pilot. For instance, many pilots ascribe to the use of risk management sheets that are filled out by the pilot prior to takeoff. These catalog risks that may be encountered that day and turn them into numerical values. If the total exceeds a certain level, the flight is altered or cancelled.

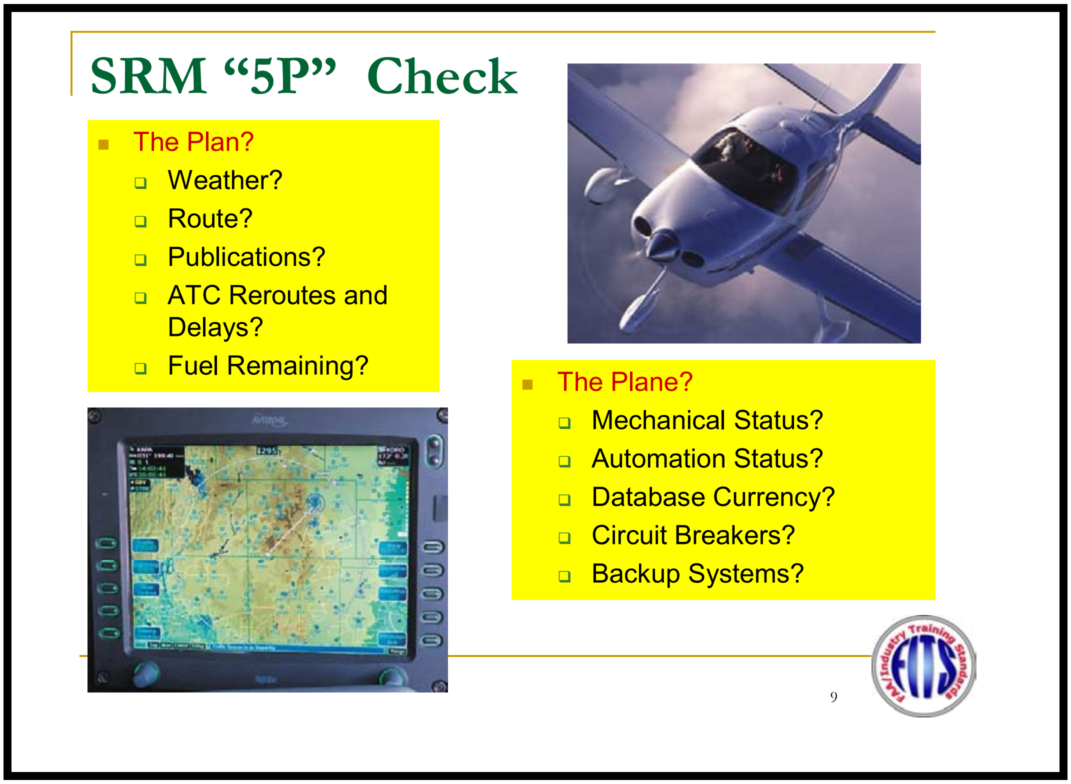
Informal research shows that while these are useful documents for teaching risk factors, they are almost never used outside of formal training programs. The number of pilots who use them before each and every flight approaches zero. The 5P concept is an attempt to take the information contained in those sheets, and in the other available models and operationalize it.

The 5P concept relies on the pilot to adopt a "scheduled" review of the critical variables at points in the flight where decisions are most likely to be effective. For instance, the easiest point to cancel a flight due to bad weather is before the pilot and passengers walk out the door and load the aircraft. So the first decision point is Pre-Flight in the flight planning room, where all the information is readily available to make a sound decision, and where communication and FBO services are readily available to make alternate travel plans.

The second easiest point in the flight to make a critical safety decision is just prior to takeoff. Few pilots have ever had to make an "emergency take-off". While the point of the 5P check is to help you fly, the correct application of the 5P before takeoff is to assist in making a reasoned go-no-go decision based on all the information available. That decision will usually be to “go”, with certain restrictions and changes, but may also be a “no-go”. The key point is that these two points in the process of flying are critical go-no go points on each and every flight.

The third place to review the 5Ps is at the mid point of the flight. Often, pilots may wait until the ATIS is in range to check weather, yet at this point in the flight many good options have already passed behind the aircraft and pilot. Additionally, fatigue and low altitude hypoxia serve to rob the pilot of much of their energy by the end of a long and tiring flight day. This leads to a transition from a decision-making mode to an acceptance mode on the part of the pilot.

The last two decision points are just prior to decent into the terminal area and just prior to the final approach fix as preparations for landing commence. Most pilots execute approaches with the expectation that they will land out of the approach every time. A healthier approach requires the pilot to assume that changing conditions (the 5Ps again) will cause the pilot to divert or execute the missed approach on every approach. This keeps the pilot alert to all manner of conditions that may increase risk and threaten the safe conduct of the flight. Diverting from cruise altitude saves fuel, allows unhurried use of the autopilot, and is less reactive in nature. Diverting from the final approach fix, while more difficult, still allows the pilot to plan and coordinate better, rather than executing a futile missed approach. Now lets look in detail at each of the “Five P’s”.



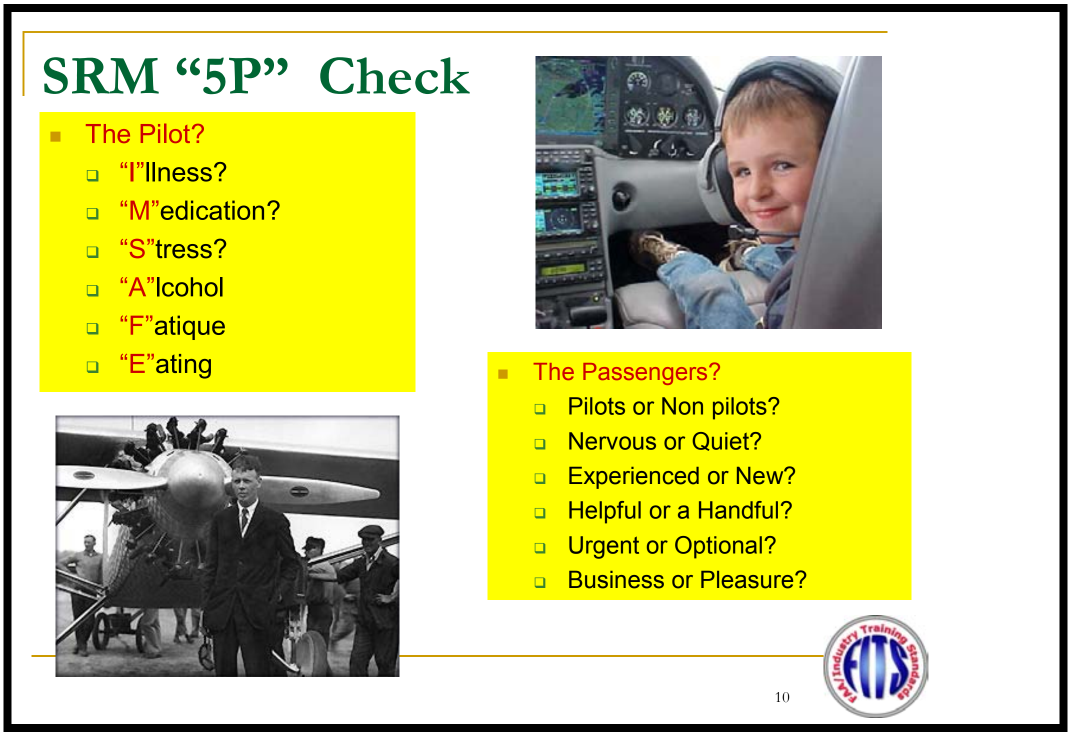
The Plan

The "Plan" can also be called the mission or the task. It contains the basic elements of cross country planning, weather, route, fuel, publications currency, etc. Unlike risk management sheets that pilot fill out before a flight, the "Plan" should be reviewed and updated several times during the course of the flight. A delayed takeoff due to maintenance, fast moving weather, and a short notice Temporary Flight Restriction (TFR) may all radically alter the plan. Several excellent flight planning software packages are available that automate this process, allowing the pilot additional time to evaluate and make decisions. Some include real time and graphical TFR depictions. The "plan" is not just about the flight plan, but the entire days events surrounding the flight and allowing the pilot to accomplish the mission. The plan is always being updated and modified and is especially responsive to changes in the other four remaining P's. If for no other reason, the 5P check reminds the pilot that the day's flight plan is a "living" document, subject to change at any time.

Obviously the weather is a huge part of any "plan." The addition of real time data link weather information give the TAA pilot a real advantage in inclement weather, but only if the pilot is trained to retrieve, and evaluate the weather in real time without sacrificing situational awareness. And of course, weather information should drive a decision, even if that decision is to continue on the current "plan."

The Plane

Both the "plan" and the "plane" are fairly familiar to most pilots. The "plane" consists of the usual array of mechanical and cosmetic issues that every aircraft pilot, owner, or operator can identity. However, with the advent of the TAA, the "plane" has expanded to include database currency, automation status, and emergency backup systems that were unknown a few years ago. Much has been written about single pilot IFR flight both with, and without, an autopilot. While this is a personal decision, it is just that, a decision. Low IFR in a non-autopilot equipped aircraft may depend on several of the other "P's" we will discuss. Pilot proficiency, currency, and fatigue are among them. The TAA offers many new capabilities and simplifies the basic flying tasks, but only if the pilot is properly trained and all the equipment is working as advertised.



The Pilot

This is an area all pilots are learning more and more about each day. TAA's, especially when used for business transportation, expose the pilot to more high altitude flying, long distance and endurance, and more challenging weather simply due to their advanced capabilities. The traditional "IMSAFE" checklist is a good start. However, each of these factors must be taken in consideration of the cumulative effect of all of them together and the insidious effects of low altitude hypoxia. The authors informal survey of TAA pilots show that almost half fly with pulse oxymeters to display the effects of low altitude hypoxia in a graphic manner.

The combination of late night, pilot fatigue, and the effects of sustained flight above 5,000 feet may cause pilots to become less discerning, less critical of information, less decisive and more compliant and accepting. Just as the most critical portion of the flight approaches (for instance a night instrument approach, in the weather, after a four hour flight) the pilot's guard is down the most. The "5P" process emphasizes that pilot recognize the physiological situation they are placing themselves in at the end of the flight, before they even takeoff, and continue to update their condition as the flight progresses. Once identified, the pilot is in an infinitely better place to make alternate plans that lessen the effect of these factors and provide a safer solution.

The Passengers

One of the key differences between CRM and SRM is the way passengers interact with the pilot. In the airline industry the passengers have entered into a contractual agreement with the pilots company with a clearly defined set of possible outcomes. In corporate aviation, the relationship between crew and passengers is much closer, yet is still governed by a set of operating guidelines and the more formal lines of corporate authority. However, the pilot of a highly capable single engine aircraft has entered into a very personal relationship with the passengers, in fact, they sit within an arms reach all of the time.

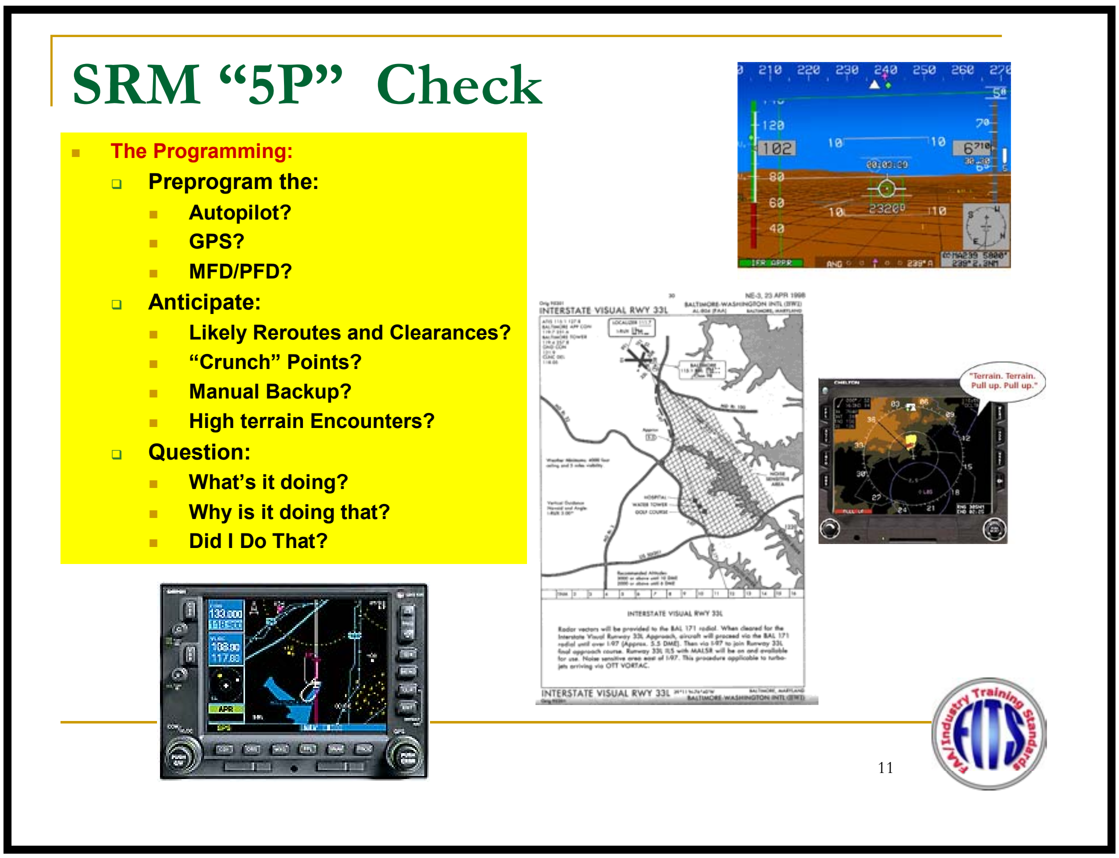
It may be easy, especially in business travel, for the desire of the passengers to make airline connections or important business meetings to enter into the pilot's decision-making loop. If this is done in a healthy and open way, it is a very positive thing. However, this is not always the case. For instance, imagine a flight to Dulles Airport and the passengers, both close friends and business partners, need to get to Washington D.C. for an important meeting. The weather is VFR all the way to southern Virginia then turns to low IFR as the pilot approaches Dulles. A pilot employing the 5P approach might consider reserving a rental car at an airport in northern North Carolina or southern Virginia to coincide with a refueling stop. Thus, the passengers have a way to get to

Washington, and the pilot has an out to avoid being pressured into continuing the flight if the conditions do not improve.

Passengers can also be pilots. The old joke says that when four Certified Flight Instructors (CFI) board a light general aviation, a NOTAM should be posted. There is some truth to this. If no one is designated as pilot in command and unplanned circumstances arise, the decision-making styles of four self confident CFI's may come into conflict. Another situation arises when an owner pilot flies with a former CFI in the right seat on a business trip. Unless a clear relationship is defined and briefed prior to the flight, the owner pilot may feel some pressure to perform for the Individual Learning Manager (possibly beyond his or her capability), and the Individual Learning Manager may feel inhibited from intervening in small decisions until it is clearly evident that the pilot is making poor decisions. This is actually a CRM situation and requires clear pre-flight understanding of roles, responsibilities, and communication. Non-Pilots can also cause the pilot to review the SRM process.

Pilots need to understand that non-pilots may not understand the level of risk involved in the flight. There is an element of risk in every flight. That's why SRM calls it risk management not risk elimination. While a pilot may feel comfortable with the risk present in a night IFR flight, the passengers may not and may manifest this during the flight. The human reaction to fear and uncertainty is as varied as the shapes of our ears. Some become quiet, some talk incessantly, and in extreme cases anger and fear are strongly manifested. This may be the last thing the pilot needs to deal with while shooting the ILS to 400 feet and a mile visibility at midnight.

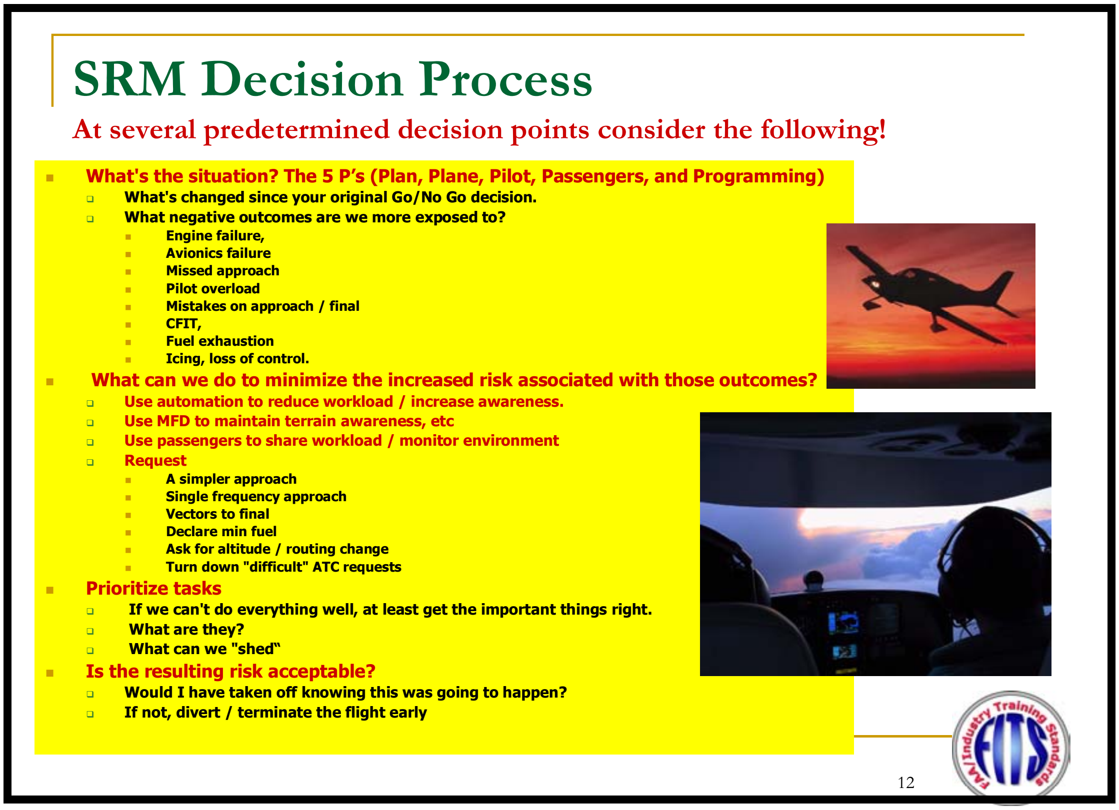
A pilot employing SRM should ensure that the passengers are involved in the decision-making and given tasks and duties to keep them busy and involved. If, upon a factual description of the risks present, the passengers decide to buy an airline ticket or rent a car, then a good decision has generally been made. This discussion also allows the pilot to move past what he or she “thinks” the passengers want to do and find out what they “actually” want to do. This removes a load of self-induced pressure from the pilot.



The Programming

The TAA adds an entirely new dimension to the way General Aviation aircraft are flown. The Glass Cockpit, GPS, and Autopilot are tremendous boons to reduce pilot workload and increase pilot situational awareness. And frankly, the programming and operation of these devises is fairly simple and straightforward. However, unlike the analog instruments they replace, they tend to capture the pilot's attention and hold it for long periods of time (like a desktop computer). To avoid this phenomenon, the pilot should plan in advance when and where the programming for approaches, route changes, and airport information gathering should be accomplished…as well as times it should not. Pilot familiarity with the equipment, the route, the local air traffic control environment, and their own capabilities vis-à-vis the automation should drive when, where, and how the automation is programmed and used.

The pilot should also consider what his or her capabilities are in response to last minute changes of the approach (and the reprogramming required) and ability to make large-scale changes (a re-route for instance) while hand flying the aircraft. Since formats are not standardized, simply moving from one manufacturer's equipment to another should give the pilot pause and require more conservative planning and decisions.



The SRM Decision Process

The SRM process is simple. At least five times, before and during the flight, the pilot should review and consider the "Plan, the Plane, the Pilot, the Passengers, and the Programming" and make the appropriate decision required by the current situation. It is often said that failure to make a decision is a decision. Under SRM and the 5P's, even the decision to make no changes to the current plan, is made through a careful consideration of all the risk factors present.

An SRM Example

The teaching of SRM is best accomplished in a seminar environment. Recently, the authors conducted a set of classroom seminars that presented real time flight scenarios to a room full of qualified pilots of varied experiences. The first scenario presented was a night MVFR/IFR flight from St Augustine Florida to Washington Dulles Airport. The original **"Plan"** called for a non-stop flight with a 45-minute fuel reserve. The **"Plane"** was a well-equipped TAA with a minor navigation light problem that delayed departure by an hour. The **"Passengers"** were one pilot and one non-pilot. The non-pilot seemed nervous about the trip and a little ill. Both passengers needed to get to Washington DC for an important meeting the next day. The **"Pilot"** had spent a full day at a flight refresher clinic, including a two-hour flight and a three-hour class, and felt reasonably refreshed at the 5 PM departure time. And finally, the GPS/MFD, the **"Programming**," combination looked like it would make the flight a snap. However, there were questions about the currency of the database that required the pilot's attention.

The discussion that followed revolved around the reliability of the weather data, the fatigue of the pilot landing at Dulles at 9 PM, alternate ways to get the passengers to their meeting, minimum requirements for aircraft night flight, and a more complete understanding of the benefits and challenges posed by GPS programming and database currency. The 5p's ensured that each pilot looked at the entire picture prior to making the critical decisions that would lay the groundwork for success or failure over four hours later in Washington.

Predictably, the destination weather deteriorated slowly as the flight proceeded northbound. The pilot's fatigue level, low altitude/long duration hypoxia, a succession of minor annoyances caused by the airplane and the passengers, began to become a factor. Again, the pilots applied the 5p's, and many decided to land short of Washington Dulles, check the weather, and secure a rental car as a backup for the Monday morning meeting (in fact many decided this prior to takeoff).

For the purposes of the discussion, this TAA was equipped with a ballistic parachute system. For those that proceeded to Dulles, the scenario ended with a spatial disorientation incident at 1500 feet, 10 miles short of the airport caused by pilot fatigue, latent hypoxia, and failure to use the autopilot. For many, it was the first time they had considered all the options available, and the criticality of quick and accurate decisions. In the background, another Individual Learning Manager began calling out altitudes and speeds as the aircraft descended to the ground, providing an added dose of realism and pressure. Should the class initiate an unusual attitude recovery, and if it did not work should they attempt another? How much will the passengers help or hinder the pilots thought processes? When, and how, should the ballistic parachute system be deployed, and what are its limitations. This scenario sparked questions about the capabilities and limitations of the autopilot, cockpit automation, and the parachute system. More importantly, it caused the pilots in the room to examine how they should gather critical information, assess the risks inherent in the flight, and take timely action. All agreed that a few accurate decisions before and during the early part of the flight reduced the risk to pilot and passengers.

All these questions were discussed in a lively thirty-minute session following the scenario. In this type of Scenario Based Training, the group discussion is just as important as the actual situation, for it is during the discussion that the pilots are most ready to learn, and begin to develop a mental model of how they might react to situations. Instead of encountering a once in a lifetime, life or death, situation alone on the proverbial dark and stormy night, the participants could examine how the situation had developed, understand the options available to them, and begin to develop a general plan of action well ahead of time.

SBT and SRM have been understood and taught in some way, shape or form by the military, airlines, and thoughtful GA Individual Learning Managers for years.

CHAPTER V: Learner Centered Grading

Collaborative Learner Centered Grading

Immediately after landing, and before beginning the critique, Linda asks her student Brian to grade his performance for the day. Being asked to grade himself is a new experience but he goes along with it. The flight scenario had been a two-leg IFR scenario to a busy class B airport about 60 miles to the east. Brian had felt he had done well in keeping up with programming the GPS and the MFD until he reached the approach phase. He had attempted to program the ILS for runway 7L and had actually flown part of the approach until ATC asked him to execute a missed approach.

When he went to place a grade in that block he noticed that the grades were different. Instead of satisfactory or unsatisfactory he found, “Explain, Practice, and Perform”. He decided he was at the Perform level since he had not made any mistakes.

When Linda returned he discovered that she had graded his flight as well, with a similar grade sheet. Most of their grades appeared to match until the item labeled “programming the approach”. Here, where he had placed a “Perform” Linda had placed a “Explain”. This immediately sparked a discussion. As it turned out, Brian had selected the correct approach, but he had not activated it. Before Linda could intervene, traffic dictated a go around. Her explain grade told Brian that he did not really understand how the GPS worked and he agreed. Now, learning could occur.

The FITS approach utilizes scenarios to teach Single Pilot Resource Management (SRM) while simultaneously teaching individual tasks such as landings and takeoffs. The authors quickly realized that this required a new approach to student performance measurement. Traditional grading approaches are generally teacher centered and measure performance against an empirical standard. The following example of a traditional flight syllabus demonstrates.

Table 6: A Traditional Grading Scale

A Traditional Grading Scale

- Excellent - the student has performed in an excellent manner
- Good – the student has exceeded basic requirements
- Satisfactory – the student has met basic standards
- Marginal – the student has failed to perform the task standards
- Unsatisfactory – the student has demonstrated significant performance difficulties

Table 7: A Traditional Lesson

Lesson Tasks	Lesson Sub Tasks	Lesson Grading
❑ Flight Planning	❑ Flight Planning ❑ Weight and Balance and Aircraft Performance Calculations	❑ U, M, S, G, E ❑ U, M, S, G, E
❑ Normal Preflight and Cockpit procedures	❑ Normal Pre-Takeoff Checklist Procedures ❑ GPS/Avionics Programming ❑ MFD /PFD Setup	❑ U, M, S, G, E ❑ U, M, S, G, E

This type of grading scale (See Table 6) is in wide use throughout the aviation training industry. While it appears to be based on published standards, in reality it is often used as a tool to determine student progress and provide motivation. Thus, on the first lesson a student may receive an “Excellent” grade for attempting to plan the flight and accomplishing the weight and balance with a few minor errors. However, by the third flight, that same performance may only earn a “Satisfactory” grade due to lack of student progress (***note that while performance remained the same the grade changed***). Additionally, the Flight Instructor awards the grade based on his or her observation of the students performance. This observation, while accurate, may not be based on an understanding of the student level of knowledge and understanding of the task. Lastly, the student has been conditioned since grade school to look at grades as a reward for performance and may feel that there is a link between grades earned and their self-esteem. In reality, none of this aids student performance in any meaningful way.

The learner centered grading approach addresses these three concerns. First the grade is now a "Desired Scenario Outcome." These outcomes describe student-learning behavior in readily identifiable and measurable terms. They reflect the student's ability to see, understand, and apply the skills and tasks that are learned to the scenario. The object of scenario-based training is a change in the thought processes, habits, and behaviors of the students during the planning and execution of the scenario. Since the training is student centered, the success of the training is measured in the desired student outcomes that are detailed in Table 8 and in Table 9.

Table 8: Desired Pilot in Training (PT) Scenario Outcomes (Maneuver Grades)

***(a)* Maneuver Grades (Tasks)**

- Explain –at the completion of the scenario the PT will be able to describe the scenario activity and understand the underlying concepts, principles, and procedures that comprise the activity. *Significant instructor effort will be required to successfully execute the maneuver.*
- Practice – at the completion of the scenario the student will be able to plan and execute the scenario. *Coaching, instruction, and/or assistance from the CFI will correct deviations and errors identified by the Instructor.*
- Perform – at the completion of the scenario, the PT will be able to perform the activity without assistance from the CFI. *Errors and deviations will be identified and corrected by the PT in an expeditious manner.* At no time will the successful completion of the activity be in doubt. ("Perform" will be used to signify that the PT is satisfactorily demonstrating proficiency in traditional piloting and systems operation skills)
- Not Observed – Any event not accomplished or required

Table 9: Desired Pilot in Training (PT) Scenario Outcomes (SRM Grades)

***(b)* Single Pilot Resource Management (SRM) Grades**

- Explain – the student can verbally identify, describe, and understand the risks inherent in the flight scenario. *The student will need to be prompted to identify risks and make decisions.*
- Practice –the student is able to identify, understand, and apply SRM principles to the actual flight situation. *Coaching, instruction, and/or assistance from the CFI will quickly correct minor deviations and errors identified by the CFI.* The student will be an active decision maker.
- Manage/Decide - the student can correctly gather the most important data available both within and outside the cockpit, identify possible courses of action, evaluate the risk inherent in each course of action, and make the appropriate decision. *Flight Instructor intervention is not required for the safe completion of the flight.*
- Not Observed – Any event not accomplished or required

(1) Grading will be conducted independently by the student and the Flight Instructor, then compared during the post flight critique.

(2) Learner centered grading (outcomes assessment) is a vital part of the FITS concept. Previous syllabi and curriculum have depended on a grading scale designed to maximize student management and ease of Flight Instructor use. Thus the traditional: "excellent, good, fair, poor" or "exceeds standards, meets standards, needs more training" often meet the Flight Instructor's needs but not the student's. The learner centered grading described above is a way for the Flight Instructor and student to determine the student's level of knowledge and understanding. "Perform" is used to describe proficiency in a skill item such as an approach or landing. "Manage-Decide" is used to describe proficiency in the SRM area such as ADM. Describe, explain, and practice are used to describe student learning levels below proficiency in both.

(3) Grading should be progressive. During each flight, the student should achieve a new level of learning (e.g. flight one, the automation management area, might be a "describe" item by flight three a "practice" item, and by flight five a "manage-decide" item.

For instance, a student who can "explain" a successful landing has achieved the basic level of competence to begin the learning process. Once the student can "explain" the effect of crosswind and speed reduction on rudder effectiveness, they have achieved a level of learning that will allow for meaningful "Practice." The "Perform" level denotes unsupervised practice and self-correction of errors. These grades are equally applicable to the first scenario to the last since they are not lesson dependent.

The grade of "Manage/ Decide" is used solely for SRM grading and the grade of "Perform" is used solely for task grading. A student who is becoming proficient at aeronautical decision-making and risk management would be graded first at the "Explain" level, then at the "Practice", and finally at the "Manage/Decide" level. A Manage/Decide or Perform grade does not describe perfection. Rather, these grades simply show a proficient pilot who corrects their own errors so that the outcome of the flight is never in doubt. Realistically, this is the performance level we desire. All pilots make mistakes, it is in learning to identify and correct mistakes that they become proficient pilots.

Table 10: Learner Centered Scenario Grading-Desired Outcome Table

Scenario Activities	Scenario Sub Activities	Desired PT Scenario Outcome
Flight Planning	1. Scenario Planning 2. Weight and Balance and Aircraft Performance Calculations 3. Preflight SRM Briefing 4. Decision making and risk management	1. Perform 2. Perform 3. Perform 4. Explain/Practice
Normal Preflight and Cockpit procedures	1. Normal Pre-Takeoff Checklist Procedures 2. GPS Programming 3. MFD Setup 4. PFD Setup	1. Perform 2. Explain/Practice 3. Practice 4. Explain/Practice
Engine Start and Taxi Procedures	1. Engine Start 2. Taxi	1. Perform 2. Perform

	3. SRM/Situational Awareness	3. Explain
Before Takeoff Checks	1. Normal and Abnormal Indications 2. Aircraft Automation Management 3. Aeronautical Decision Making and Risk management	1. Perform 2. Explain/Practice 3. Manage/Decide

The previous desired outcome table denotes a student near the beginning of training and the grades reflect proficiency of the students to an expected level of performance in each of these areas. These grades are not self-esteem related since they do not describe a recognized level of prestige (such as A+ or “Outstanding”), rather a level of performance. You can’t flunk a lesson. However, you can fail to demonstrate the required flight and SRM skills. By reflecting on the lesson and grading their own performance, the student becomes actively involved in the critique process. Student participation in the process also reduces the self-esteem issue. But most importantly, this establishes the habit of healthy reflection and self-criticism that marks most competent pilots.

Chapter VI: Putting It All Together

Lets examine a typical scenario where a typical flight school or FBO can use the FITS Generic Syllabus to develop a tailored, aircraft specific, FITS accepted transition curriculum. The first step is to log onto the FITS website, http://www.faa.gov/education_research/training/fits/ and select the "FITS Training and Curriculums". Under the Curriculums heading select the "Generic" option. There you will find the generic syllabi and the FITS criteria. Please note that the formats of the generic syllabi are not required to be followed for your course to be FITS accepted. When reviewing the course, the FAA is looking for adherence to the FITS criteria. There are 4 levels of FITS acceptance that are described below:

1. <u>Accepted FITS Flight Syllabus</u>: Will contain all the tenets of FITS and will include flight in an aircraft or at least an Advanced Training Device. Examples of this type of syllabus include initial, transition, and recurrent training syllabi.
2. <u>Accepted FITS Syllabus (No flight)</u>: It is not intended to teach the pilot in training (PT) psychomotor pilot skills or full cockpit/aircraft integration in a specific aircraft. It's intended to enhance certain skill sets of the PT. Application of this level of acceptance may be to teach the PT how to use a new glass cockpit display or develop better SRM skills. A FITS Accepted Syllabus will also contain all the tenets of FITS. A live Flight Instructor will lead the training.
3. <u>Accepted FITS Self-Learning Program:</u> This acceptance is between the FITS Accepted Syllabus and FITS Supporting Material. It may be either an interactive CD or on-line course on a specific application or subject. The purpose of this training is to learn a specific piece of equipment or enhance a specific higher order thinking

skill. Scenario training and/or testing is required. Since a live Flight Instructor is not required, Learner Centered Grading may not be applicable.

a. If the program is for a piece of equipment (i.e. GPS), the equipment should act like the actual piece of equipment during the interaction with the equipment (to a point). After basic training on the equipment, scenarios should be used to demonstrate PT proficiency and knowledge. The program should allow errors and demonstrate the consequences of those errors.

b. For non equipment programs (i.e. ADM development) scenarios with multi-string testing should be used.

4. Accepted FITS Supporting Material: These products do not meet the training tenets of FITS (i.e. may not be scenario based), but the subject is integral to FITS. These products could be accepted on their own technical merit, but only as a part of an Accepted FITS Flight Syllabus or FITS Syllabus. For example, a CBI on risk management could be accepted as and used as a module in a FITS accepted transition syllabus. Original equipment manufacturers (Cessna, Cirrus, Eclipse, etc.) or developers of training materials (Sporty's, Jeppesen, King Schools, etc.) normally develop Accepted FITS Supporting Material.

MASTER SYLLABUS - SCENARIO BASED TRANSITION

OBJECTIVE

The Pilot in Training (PT) will demonstrate a basic knowledge and proficiency in avionics, aircraft system equipment location and normal operating procedures.

FITS Generic Transition Syllabus

While the syllabus may look familiar at first, it is actually a set of five detailed flight scenarios designed to integrate single pilot resource management skills while training the pilot in the aircraft flying and automation skills required of a TAA.   One of the first changes you will notice is the emphasis on the use of automation during the first flight. While normally the student might concentrate on flying landing patterns on the first flight in a new aircraft, in a TAA it is important to master the electronics to a level that will keep the student from being distracted and not deterring from looking outside the aircraft for other aircraft. Those who have instructed in GPS equipped aircraft will know that they demand a lot of heads down time. By getting used to the new equipment early, those distractions are reduced and actual flight proficiency is increased.

Garmin G-1000

SCENARIO 1

Preflight

The PT will plan a short VFR cross-country flight of about one hour or less in duration, to include a full stop landing at an airport other than the departure airport, and return to the airport of origin.

The PT will perform all weight and balance as well as performance calculations, and describe his/her approach to management of the specific risks involved in this flight. The Flight Instructor will provide the necessary guidance to insure that the plan provides for all the scenario activities and sub-activities listed for this lesson. The PT is evaluated on the ability to plan a comprehensive flight with conscious attention to all the required scenario activities.

The PT will perform all preflight procedures, engine start-up, avionics set-up, taxi and before-takeoff procedures for each leg of the scenario.

FITS Generic Transition Syllabus

FITS training is based on the concept of scenario based training. Realistic cross-country flight scenarios planned and executed by the student with assistance from the Flight Instructor begin the early development of cockpit management skills, situational awareness, and aeronautical decision-making. Continued engagement by the student in the planning, executing, and grading of each scenario reinforce it throughout the training. Let us re-emphasize this point; the student is responsible for planning the flight scenario from a menu of short cross-country flights developed by the training provider. While the Flight Instructor will certainly assist the student in aircraft performance data, weight and balance, and general aircraft layout prior to the first lesson, the sooner the student assumes these responsibilities, the better the learning environment. The scenario description contained in the generic syllabus is just a starting point for the training provider. Scenarios can be tailored for the local weather and terrain conditions and are most effective when they replicate the environment most likely encountered by the students.

Leg 1 (Outbound flight)

The PT will perform a normal takeoff and departure to a safe altitude. When established in the departure climb-out, the autopilot will be engaged. Climbing turns will be performed during the departure on autopilot with a transition to VFR cruise. Aircraft systems, avionics and autopilot functions will all be practiced during cruise, descent and normal landing phases of the flight. The VNAV function will be used for the descent and the IFR pilot will execute a coupled ILS approach. The VFR pilot will perform a normal descent and traffic pattern transition followed by a normal approach and landing to a full stop. Experience has shown that this first autopilot leg should be kept very simple to allow the pilot to become more comfortable with cockpit automation.

FITS Generic Transition Syllabus

The individual scenario developer should tailor the generic syllabus to the local flight environment and the missions that a typical owner/pilot might fly. Several first flight scenarios may be developed to allow for weather and different customer requirements. This scenario begins with a normal takeoff, followed by an autopilot climb, GPS navigation leg, and a descent using the autopilot.

Remember the glass cockpit/GPS is not in itself difficult to master; in fact most of the new systems are very user friendly and immensely capable. However, they offer different visual cues and they do require more head down time to operate, especially if the pilot makes a mistake in programming. On the other hand, the new systems make the aircraft much more capable of operation in the National Airspace System and may give the pilot more confidence to go, where as, in an older technology aircraft, the pilot might have feared to tread. By spending time early in the aircraft familiarization phase becoming comfortable with the "Glass", the student is now able to focus more clearly on the other aircraft tasks without spending undue time head down in the cockpit.

Sample Training Provider Syllabus
Scenario One, Leg One

The PT will plan a flight from the Daytona Beach, FL Airport to the St. Augustine, FL Airport. The PT will perform a normal takeoff and departure to a safe altitude.

When established in the departure climb, the autopilot will be engaged. Climbing turns will be performed during the departure on autopilot with a transition to VFR cruise. Aircraft systems, avionics and autopilot functions will all be practiced during cruise, descent and normal landing phase of the flight.

For IFR pilots, the VNAV function will be used for the descent and a coupled ILS at St. Augustine will be demonstrated by the Flight Instructor pilot.

A VFR pilot will perform a VNAV descent and pattern transition followed by a normal approach and landing to a full stop.

The return leg introduces basic flying skills after the pilot has gained familiarity and comfort with the automation. The student is responsible for basic PFD/MFD setup and navigation programming while performing familiar tasks (slow flight, stalls, and landings) in a new aircraft, reducing head down time, confusion about switchology and cockpit display interpretation.

Scenario One, Leg Two

The student pilot will fly the return trip to Daytona manually in order to become familiar with the handling characteristics of the aircraft. Slow flight and stalls will be performed now that the student pilot has had time to become familiar with the Pilot Flight Display (PFD) and the navigation automation. The slow flight and stalls will be integrated with the enroute portion of the flight and presented, as they would occur in the course of a normal cross-country flight. The emphasis will be on stall identification and recovery.
The pilot will practice landings at Flagler County, FL airport before returning to Daytona for a full stop landing from an ILS approach.

During each leg of the flight the student is encouraged to take more and more responsibility for the conduct of the flight and to make the decisions required to safely complete the scenario. Since fast, well-equipped TAA spend a lot of their time in the cross-country environment, a premium is placed on pilot situational awareness, risk management, and decision-making.   In FITS parlance that is called Single Pilot Resource Management or (SRM).

Single Pilot Resource Management (SRM)

The art and science of managing all the resources (both on-board the aircraft and from outside sources) available to a single-pilot (prior and during flight) to ensure that the successful outcome of the flight is never in doubt. The primary emphasis will be on integrating the developing and enhancement of the mental process and underlying thinking skills needed by the pilot to consistently determine the best course of action in response to a given set of circumstances. SRM integrates all of the following concepts:

- Aeronautical Decision Making and Risk Management
- Automation Management
- Task Management
- Situational Awareness
- CFIT Awareness

FITS Generic Transition Syllabus

The combination of the new ATC and aircraft technology offers the pilot an abundance of information to use while in flight. Data linked traffic, weather, and especially the moving map GPS or MFD can make General Aviation flying safer and more predictable with the right training. That's where the Instructor comes in. Single Pilot Resource Management is a tool that will help the student become a better information manager and decision maker. Accident statistics show that the rate of needless fatalities due to poor pre-flight and in-flight decision-making is too high. SRM applies to everything from Cessna 150's to the latest glass cockpit aircraft, but is especially critical for the single pilot operating IFR in a busy traffic area.

One of the keys to SRM is to make programming and management of the GPS/MFD easy and less time consuming (another reason to introduce it early in the syllabus). You have surely watched as a pilot who is programming a GPS allows the aircraft control to suffer. Digital equipment consumes a great deal of "brain time" and like your desktop computer, can very seductively consume all of your attention. Pilots who exhibit good SRM skills strike a balance between managing the automation, managing all the other tasks associated with the flight, maintaining good situational awareness, and making informed and timely decisions.

SRM is described in detail in section 5 of the Generic Transition Syllabus (and Chapter IV in this document). As the flight instructor explains SRM to the student, they should notice that each description is stated in behavioral terms. For instance, a pilot who excels at task management will," prioritize and select the most appropriate tasks (or series of tasks) to ensure successful completion of the flight."

If the student is busy programming the GPS and receiving the ATIS information while accidentally flying through the final approach course, the reason is probably poor task management rather than poor instrument skills. Instead of giving an overall grade for judgment or ADM, SRM skills can come and go as the flight progresses. During cruise it is fairly easy to remain ahead of the aircraft. However, during an IFR arrival into a busy terminal, the same cannot be said. So SRM is graded during each leg of the flight.

Each flight's activities are listed in a task list just like the one below. This list covers all the activities that the student will be expected to plan, execute, and complete on the first two scenario based flights. Take a moment and review the list then scroll down to the end:

Table 11: Scenario Activities and Desired Outcomes

Scenario Activities	Scenario Sub Activities	Desired PT Scenario Outcome
Flight Planning	1. Scenario Planning 2. Weight and Balance and Aircraft Performance Calculations 3. Preflight SRM Briefing 4. Decision making and risk management	1. Explain 2. Explain 3. Explain 4. Explain
Normal Preflight and Cockpit procedures	1. Normal Pre-Takeoff Checklist Procedures 2. GPS Programming 3. MFD Setup 4. PFD Setup	1. Practice 2. Explain 3. Explain 4. Explain
Engine Start and Taxi Procedures	1. Engine Start 2. Taxi 3. SRM/Situational Awareness	1. Practice 2. Practice 3. Explain
Before Takeoff Checks	1. Normal and Abnormal Indications 2. Aircraft Automation Management 3. Aeronautical Decision Making and Risk management	1. Explain 2. Explain 3. Explain
Takeoff	1. Normal Takeoff 2. Crosswind Takeoff 3. Situational Awareness 4. ADM and Risk Management	1. Practice 2. Practice 3. Explain 4. Explain
Climb procedures	1. Manual Climb 2. Autopilot Climb 3. Navigation programming 4. Power management 5. Situational Awareness, Task management, and ADM	1. Practice 2. Practice 3. Explain 4. Explain 5. Explain
Cruise Procedures	1. Lean Assist (if so equipped) 2. Best Power vs. Best Economy 3. Manual Cruise 4. Autopilot Cruise 5. Navigation programming 6. Task Management, SA, and ADM	1. Explain 2. Explain 3. Practice 4. Practice 5. Explain 6. Explain
Control Performance Instrument /Visual Crosscheck **Note: All items will be accomplished enroute during the scenario**	1. Straight and level 2. Normal Turns 3. Climbing and Descending Turns 4. Steep Turns	1. Practice 2. Practice 3. Practice 4. Practice
Low Speed Envelope **Note 1: Slow Flight and Stall Recovery may be accomplished enroute or in a practice area** **Note 2: Emphasis will be placed on stall prevention and recovery**	1. Configuration Changes and Slow Flight 2. Recovery from Power Off Stalls 3. Recovery from Power On Stalls 4. Stall prevention, SA, TM, and ADM	1. Practice 2. Practice 3. Practice 4. Explain

GPS Operation and Programming	1. VFR (non instrument rated PT) a. Direct-To b. Nearest c. Airport Information d. Flight Plan 2. IFR (instrument rated PT) a. Direct-To b. Nearest c. Airport Information d. Approach Select e. Flight Plan	1. Explain 2. Explain
Autopilot Programming, Modes and Annunciators	1. Vertical Speed and Altitude Hold 2. Navigation Modes 3. Flight Director/PFD Interface	1. Practice 2. Explain 3. Explain
Avionics Operation	1. Pilot Flight Display (if installed 2. MFD Normal Operation a. Setup Pages b. Navigation Mode c. Checklist Mode 3. EHSI Operation	1. Explain 2. Practice 3. Practice
Avionics Interface	None this Scenario	N/A
Data link Situational Awareness Systems and Additional Avionics Setup	Data link Traffic Setup and operation	Explain
Emergency Escape Maneuvers, Emergency Procedures/Recovery from Unusual Attitudes and Upsets/Use of Ballistic Parachute Recovery System (BRS)	BRS	Explain
Descent Planning and Execution	1. Automation Management 2. VNAV Planning 3. Navigation programming 4. Manual Descent 5. Autopilot descent 6. TA, SA, CFIT Avoidance	1. Explain 2. Explain 3. Explain 4. Practice 5. Practice 6. Explain
Instrument Approach procedures (IFR Rated Pilot)	1. Manual ILS 2. Coupled ILS	1. Explain 2. Explain
Landing	1. Before landing procedures 2. Normal Landing 3. Crosswind landing 4 ADM and SA	1. Practice 2. Practice 3. Explain 4. Explain
Aircraft Shutdown and Securing procedure	1. Aircraft Shutdown and Securing Checklist 2.Aircraft Tie down	1. Practice 2. Practice

FITS Generic Transition Syllabus

You should notice that SRM and its components are graded during each leg of the flight and that the grading scale is quite different than what you may be accustomed.

Since the focus of FITS is on student learning, FITS grading is expressed in terms of student performance.

In the past we have used fairly simple grading matrixes like **Unsatisfactory** or **Satisfactory**, **Good**, **Fair**, or **Poor,** or **Proficient** vs. **Non Proficient**. The problem has always been that a Satisfactory grade for flight number one may be an Unsatisfactory grade on flight number three. These grades describe a level of performance as compared to syllabus requirements. Why not grade the student based on their demonstrated knowledge and ability? In fact, why not have the student participate in the grading process? FITS grading does just that.

Lets look at an example. A student can describe a landing in his airplane and can tell you about the physical characteristics and appearance of the landing. And on a good day, with the wind straight down the runway, they may be able to **Practice** landings with some success while still functioning at the rote level of learning. However, on a gusty crosswind day the student will need a deeper level of understanding to adapt to the different conditions. So, if student can **Explain** all the basic physics associated with lift/drag and crosswind correction, they will be more likely to successfully **Practice** and eventually **Perform** a landing under a wide variety of conditions.

The same holds true for SRM. The student may be able to describe basic SRM principles during the first flight. Later they will be able to **Explain** how SRM applies to different scenarios that are presented on the ground and in the air. When they actually begin to make quality decisions based on good SRM techniques they earn a grade of **Manage/Decide**. The advantage of this type of grading is that both Flight Instructor and student know exactly where the student learning has progressed.

In fact, the preferred method (referred to as collaborative learner centered grading) is for the student and Flight Instructor to grade the flight separately and compare notes. Where both agree little discussion is required. Where significant differences occur, a useful discussion, often led by the student, should follow. Learner centered grading takes the burden off the Flight Instructor, and places it on the student where it belongs. Grades are only useful if they improve student performance! Just like SRM, the performance standards are listed in section 5 of the syllabus for the typical student and CFI to use.

Table 12: Engine Start and Taxi Procedures

TAA 04	**Engine Start and Taxi Procedures**	
Unit Objective – Demonstrate the proper Engine Start and taxi procedures for the TAA		
Performance	Conditions	Standards
The training task is:	The training is conducted during:	The pilot in training will:
1. Engine Start	a. Pre-arrival – eLearning b. Pre-flight briefing c. Actual aircraft pre-flight	a. Demonstrate the correct procedures for engine start under all conditions b. Demonstrate the correct emergency procedures associated with engine start. c. Successfully start the engine
2. Taxi	a. Pre-arrival – eLearning b. Actual aircraft pre-flight	a. Understand the proper technique to control the aircraft using differential braking and power b. Successfully taxi the aircraft
3. SRM/Situational Awareness	a. Pre-arrival – eLearning b. Actual aircraft pre-flight	a. Understand the capability of the MFD/GPS to aid in low visibility/congested airport taxi situations b. Demonstrate the proper visual clearing techniques during all taxi operations

FITS Generic Transition Syllabus

Basic flight tasks are, of course, covered in the FITS syllabus also and in all cases meet or exceed the Practical Test Standards.

Table 13: Low Speed Envelope

TAA 10	**Low Speed Envelope**	
Unit Objective – recognize the onset of low speed flight regimes and demonstrate the proper use of flight controls and Visual or PFD derived cues to perform basic low speed flight maneuvers in the TAA		
Performance	Conditions	Standards
The training task is:	The training is conducted during:	The pilot in training will:
1. Configuration changes 2. Slow Flight	a. Pre-Flight briefing b. In Flight	Demonstrate slow flight within the PTS standard with the flaps in all possible flap positions and detents
3. Recovery From Power –Off and Power -On Stalls		a. Demonstrate a recovery from a planned Power-Off or Power-On Stall with minimum altitude loss. b. Demonstrate a recovery from an Flight Instructor induced Power-On/Power-Off stall with minimum altitude loss.
4. Recovery from autopilot induced stall		Demonstrate a recovery from an autopilot induced stall with minimum altitude loss
5. Stall Prevention, Situational Awareness, Task Management, and Decision Making		a. Describe possible situations that might lead to an inadvertent stall and cockpit indications that would warn of an impending stall b. Demonstrate pilot actions to avert the stall prior to its occurrence

FITS Generic Transition Syllabus

You will notice some new categories not found in the FAA Practical Test Standards. The student is only responsible for those areas that the aircraft is equipped and capable of performing. Most of these have to do with the emerging class of data link information and electronic avionics. However, if it is installed on the aircraft, the pilot should know how to use it. If the student’s airplane only has a moving map GPS, then you should only work on the tasks listed in table 14.

Table 14: GPS Operation and Programming

TAA 15 GPS Operation and Programming		
Unit Objective – demonstrate proficiency with the GPS		
Performance	Conditions	Standards
The training task is:	The training is conducted during:	The pilot in training will:
1. VFR: Direct-To Function Nearest Function Airport Information Function Flight Plan Function	a. In-flight	Demonstrate proficiency using the GPS including the Direct-To, Nearest, and Airport Information functions
2. IFR: Direct-To Function Nearest Function DP/STAR/Approach Function Flight Plan Function – Integration with…	a. Pre-flight b. In-flight	a. Demonstrate proficiency using the GPS including the Direct-To, Nearest, Airport Information, DP/STAR/Approach functions b. Demonstrate proficiency flight planning the GPS and flying the flight plan

FITS Generic Transition Syllabus

However, if the student bought all the "bells and whistles" (PFD/MFD/Autopilot) then you will use the additional tasks listed below as a guide.

Table 15: Automated Avionics Interface

TAA 14	Automated Avionics Interface	
Unit Objective – demonstrate proficiency interfacing the avionics for flight operations		
Performance	Conditions	Standards
The training task is:	The training is conducted during:	The pilot in training will:
1. Identification of Data/Power Sources a. Air Data failure b. AHRS failure c. Generator/battery failure	a. Pre-Arrival E learning b. Classroom c. Pre-flight d. In-flight	a. Understand data/power source failure modes that affect operation of the PFD. b. Identify specific failures and their associated cues.
2. Identification of PFD Failure Modes and corrective actions a. Invalid Sensor Data b. Invalid Heading c. Crosscheck Monitor d. Recoverable Attitude e. Invalid Attitude and Heading f. Complete/partial Electrical Power failure		Perform the appropriate corrective action for each malfunction.
3. Aircraft Automation Management		a. Understand and be able to correctly describe the interface between all the installed avionics systems in the aircraft b. Demonstrate proficiency operating the Avionics installed on the aircraft as an integrated system

FITS Generic Transition Syllabus

In a typical three day scenario based transition training course, for example, a student may manage to log ten to twelve hours in his logbook and earn **Practice, Perform** and **Manage/Decide** grades in all areas. But more than that, all of the training would be conducted in the real world of ATC, weather, and unfamiliar destinations. The student will make a variety of decisions. Each evening they self identify the areas for additional study and practice. The flight scenarios and ground scenarios presented sharpen the students thinking skills and make them more competent and confident decision makers. The collaborative Lerner centered grading process establishes the habit of useful self-criticism that is evident in all good pilots.

Since the syllabus is presented in the real world of cross-country flying, the Flight Instructor observes the students response to a variety of situations. In the end, the student is a safer pilot, a better insurance risk, and will come see you for more training in the future. That’s a good combination. Fly Safe!!

Appendix One: Related Terms and Abbreviations

Aircraft Automation Management **–** The demonstrated ability to control and navigate an aircraft by means of the automated systems installed in the aircraft.

Automated Navigation leg **–** A flight of 30 minutes or more conducted between two airports in which the aircraft is controlled primarily by the autopilot and the on board navigation systems.
A ***VFR Automated Navigation Leg*** is flown on autopilot from 1,000 ft AGL on the departure until entry to the 45-degree leg in the VFR pattern.

An ***IFR Automated Navigation Leg*** is flown on autopilot from 500 ft AGL or the lowest altitude permitted by the AFM or AFM supplement on departure until reaching the decision altitude (coupled ILS approach) or missed approach point (autopilot aided non-precision approach) on the instrument approach. If a missed approach is flown, it will be flown using the autopilot and on-board navigation systems.

***Automation Competence*-** The demonstrated ability to understand and operate the automated systems installed in the aircraft.

***Automation Surprise*-** The ability of automated systems to provide different cues to pilots when compared to the analog systems they replace, especially in time-critical situations.

Automation Bias **–** The relative willingness of the pilot to trust and utilize automated systems.

***Candidate Assessment*-** A system of critical thinking and skill evaluations designed to assess a student's readiness to begin training at the required level.

Critical Safety Tasks/Events **–** Those flight related tasks/events that if not accomplished quickly and accurately may result in damage to the aircraft or loss of life.

Data link Situational Awareness Systems – Systems that feed real-time information to the cockpit on ***weather, traffic, terrain, and flight planning***. This information may be displayed on the PFD, MFD, or on other related cockpit displays.

Desired Pilot in Training (PT) Scenario Outcomes - The object of scenario-based training is a change in the thought processes, habits, and behaviors of the students during the planning and execution of the scenario. Since the training is student-centered, the success of the training is measured on a grading scale that provides more effective feedback to both the PT and the Flight Instructor than the "Outstanding, Satisfactory, Unsatisfactory" or "exceeds standards, meets standards, needs more training" scale often meet the Flight Instructor's needs but not the student's. See Chapter V Tables 8 and 9 for a full description of the grading scale.

***Emergency Escape Maneuver*-** A maneuver (or series of maneuvers) performed manually or with the aid of the aircraft's automated systems that will allow a pilot to successfully escape from an unanticipated flight into Instrument Meteorological Conditions (IMC) or other life-threatening situations.

***Individual Learning Manager*-** He/she is trained to function in the learning environment as an advisor and guide for the learner. The duties, responsibilities, and authority of the Individual Learning Manager include the following:

7. Orient new learners to the scenario-based training system.
8. Help the learner become a confident planner and in flight manager of each flight and a critical evaluator of their own performance.
9. Help the learner understand the knowledge requirements present in real world applications.
10. Diagnose learning difficulties and help the individual overcome them.
11. Be able to evaluate student progress and maintain appropriate records.
12. Provide continuous review of student learning.

***Mission Related Tasks*-** Those tasks required for safe and effective operations within the aircraft's certificated performance envelope.

Multi-Function Display MFD - Any display that combines primarily navigation, systems, and situational awareness information onto a single electronic display.

Primary Flight Display (PFD) – Any display that combines the primary six flight instruments, plus other related navigation and situational awareness information into a single electronic display.

***Proficiency-Based Qualification*-** Aviation task qualification based on demonstrated performance rather than other flight time or experience.

***Simulation*-** Any use of animation and/or actual representations of aircraft systems to simulate the flight environment. Student interaction with the simulation and task fidelity for the task to be performed are required for effective simulation.

Training Only Tasks **–** Training maneuvers that while valuable to the student's ability to understand and perform a mission related task, are not required for the student to demonstrate proficiency. However, certified flight instructors would be required to demonstrate proficiency in Training Only Tasks.